Egyptian Journal of Biological Pest Control, 19(1), 2009, 31-35

Survey of Spiders (Araneae) and Study the Effect of Crop Variety and Pesticides on their Populations in Egyptian Soybean Fields

Hendawy, A. S.; R. I. E. Magouz and A. M. A. Nassef
Plant Protection Research Institute, Agricultural Research Center, Giza, Egypt
(Received: March 1, 2009 and Accepted: March 28, 2009)

ABSTRACT

An investigation to survey the spider complex in soybean fields at Sakha Agricultural Research Station in 2006 and 2007 seasons was carried out. The spiders were surveyed using five collecting methods: pitfall traps, vacuum machine, sweep net, water pan traps and cloth sheet. The survey revealed the occurrence of 32 spider species belonging to 13 families. The most abundant were: *Singa* sp, *Dictyna* spp., *Bathyphantes* sp., *Pardosa* spp., *Thanatus albini* (Audouin) and *Thomisius* spp. The second rank was occupied by *Larinia* sp., *Erigone dentipalpis* (Wider), *Wadicosa fidelis* (O.P. Cambridge), *Cheiracanthium* spp., *Ballus* sp. *Thyene imperialis* (Rossi) and *Theridion* sp. Population density of the spiders was higher in the soybean Crawford cultivar than in Giza111. The acaricides; Endo, Neoron and Ortus were more toxic (81.83 - 87.88 % spider reduction) than insecticides (35.77 - 72.96 % reduction).

Key words: Spiders, soybean, survey, crop variety, Acaricides, Egypt.

INTRODUCTION

Soybean, *Glycine max* (L.) is one of the important legume crops allover the world. Seeds of soybean have a high nutritional value and their proteins contain many essential amino acids (Badenhop and Hackler, 1971).

Beneficial arthropods on soybean fields have been studied and catalogued in Egypt (El-Dakhakhny *et al* 1996, Gamieh and El-Basuony 2001, Mesbah *et al* 2001 and Magouz, 2003), but the true spiders (Areneae) in particular have received very little attention (Sallam 1996).

True spiders are considered an important component of the naturally occurring complex of predatory arthropods in field crops. Because all spiders are obligate insectivorous predators, and because insects constitute their principle prey, the community role of spiders is of concern to entomologists. Spiders are among the most abundant predators recorded in some field crops in Egypt (Sherif *et al* 2001, Hendawy 2004, Hendawy and El-Mezayyen 2003 and Hendawy and Abul-Fadl 2004).

Spiders are abundant generalist predators in soybean agro-ecosystems (LeSar and Unzicker, 1978 and Culin and Rust, 1980). Culin and Yeargan (1983a and b) and Rypstra and Marshall (2005) documented a high diversity of spiders in soybean fields. As a complex of carnivorous predators, spiders consume a wide spectrum of herbivorous insects, and thus may contribute to control of soybean herbivores, which reduce soybean yield (Herbek and Bitzer, 1988). The direct way to determine the biocontrol effectiveness of spiders is to manipulate their numbers in field experiments.

The current investigation was dedicated as a contribution to the knowledge of some ecological aspects of spiders in soybean fields in Egypt.

MATERIALS AND METHODS

1. Study Area

Spider collections were conducted in soybean fields (about one feddan) at Sakha Agricultural Research Station (SARS), Kafr El- Sheikh Governorate. The varieties Crawford and Giza 111 were cultivated on April, 15th and 17th in 2006 and 2007 seasons, respectively and harvested approximately 4 months later. Throughout the two seasons, no pesticides were applied.

2. Survey:

Pitfall traps, vacuum machine, sweep net; water pan traps and cloth sheet were used every 7-10 days throughout the two seasons; 2006 and 2007 to collect spiders from soybean plantations.

3. Sampling techniques:

Pitfall traps and vacuum machine were used to collect ground and foliage spiders, during the period from May 15th to August 10th.

3.1. Ground species:

Ground-active spiders were collected by pitfall traps. Wide mouthed glass jars (6 cm diameter X 10 cm deep) were used as pitfall traps having water to about 10 cm height, 5 ml of 2% formalin solution to kill and preserve the captured arthropods, and 5 ml of Tween 80 as a detergent. Ten pit-fall traps were embedded between rows and into the dikes in an area of ½ feddan, Sampling was undertaken at 7-10 days intervals. The catch was collected by screening the water of the jar with its captured arthropods through a fine sieve. The obtained catch

was placed into glass jars, and transferred to the laboratory for classification. The specimens were identified and confirmed by Dr. Alberto Barrion, Systematic Laboratory, International Rice research Institute, Philippines and Mr. Hesham El-Hennawy, Arab Republic of Egypt. A metal cover (15 cm X 15 cm) supported by three nails (9 cm length) was placed over each trap to prevent rats to fall in the traps.

3.2. Foliage species

Vacuum machine (D-vac) was used to collect the spiders from the foliage of soybean plants every 12–14 days throughout the season. A 10 m row of soybean was sampled by slowly moving the vacuum nozzle through the foliage up and down the plant stem along each side of the row. The samples were collected in bags and transferred to the laboratory for classification.

4. Pesticides studies:

The residual effect of the acaricides (Endo, Neoren and Ortus) and insecticides (Pestban and Spinosad) on true spider was investigated. The pesticides were sprayed on 16 June. The spiders were sampled using vacuum machine from treated and untreated plots. Sampling began just before insecticide treatments and continued 3 weeks post-treatments.

A field experiment was conduced at (SARS) during 2007 season to study the effect of certain comman pesticides on true spiders. An area of about 1/4 feddan was divided into 28 plots, each of 20 m^2. The soybean variety Crawford was sown in 28 plots during the first week of June. The plants received usual agricultural practices without any pesticidal treatments. Every compound was applied in a complete randomized block design, with four replications at its recommended rate. The previous compounds were sprayed on 17th June using Knapsack sprayer (model CP3). Spiders were collected at random from each plot before and after 1, 3, 7, 14 and 21 days from spraying. Spiders and spiderlings were counted and recorded. Percentage of reduction in population of spiders was estimated. Data were subjected to analysis of variance, and significantly differed means were compared using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Identifications of the collected spiders revealed the occurrence of 32 spider species belonging to 13 families.

As shown in table (1), the first rank (***) of occurrence was occupied by the species, *Singa* sp., *Dictyna* spp., *Bathyphantes* spp., *Pardosa* spp., *Thanatus albini* (Audouin), and *Thomisus* spp. which were detected by all collecting methods. The second rank (**) was occupied by, *Larinia* sp., *Erigone dentipalpis* (Wider), *Wadicosa fidelis* (O.P. Cambridge), *Cheiracanthium* spp., *Ballus* sp., *Thyene imperialis* (Rossi) and *Theridion* sp. These spiders were commonly collected by a vacuum machine, sweep net and cloth sheet. The remaining spiders came third (*), and were mainly caught by a vacuum machine and/or pitfall traps, and sometimes by sweep net.

Pearce *et al.* (2004), in Queensland, surveyed 102 morphospecies of spiders from 28 families using vacuum sampling and pitfall traps across to soybean seasons. Sallam (1996) reported that, compared to cotton and maize, smaller population of spiders occurred in soybean fields in Egypt. The species *Lycorma ferox* (Lycosidae) trapped in pitfalls was the most abundant. Family Philodromidae represented by *Philodromus* sp. and *Thanatus albini* were second in abundance.

Results in Table (2) show that Crawford soybean variety harbored more spiders than Giza 111 did, with a total spider population of 281 and 120 individuals, respectively. This could be interpreted as Crawford was more susceptible to the cotton leafworm than Giza 111 (field observation). Most of surveyed spider species (Table 2) fed upon early instars of the cotton leafworm.

The means of spiders inhabiting both varieties of soybean were compared using 't' test (Table 2). The population density of spiders differed highly significant in both varieties.

Table (3) shows the numbers of spiders as influenced by pesticides (acaricides and insecticides) applications. Endo, Neoron and Ortus caused complete spider mortality one day after applications. The mortality was reduced by elapsing the period of pesticides application. Three weeks after application, 86,118,129,192,456 spider individuals were obtained per 10 m vacuumed soybean plants for Endo, Neoron, Ortus, Pestban and Spinosad, respectively. The corresponding numbers of spider collected 21 days in water and untreated plots were 646 and 710 individuals. Thus, the reductions in spider population were 87.88, 83.38, 81.83, 72.96, 35.77, and 9.01 % for Endo, Neoron and Ortus, Pestban, Spinosad and water, respectively. The results revealed that acaricides were more toxic to spiders than insecticides. The mortality due acaricides ranged 81.83-87.88 % while that of insecticides ranged 35.77-72.96 %, which indicates that insecticides were relatively safer to spiders than

Table (1): List and abundance of spiders' species collected from soybean fields by different methods at Kafr El-Sheikh Governorate, 2006 and 2007 seasons.

Family/Common name	Genus, species	Collection method	Abundance
Araneidae (Typical-orb weavers)			
	Cyclosa insulana (Costa)	V,S	*
	Hyposinga sp.	V ,S,C	*
	Larinia sp.	V ,S,C	**
	Singa sp.	P,V,S,C,W	***
	Araneus sp	V	*
	Argiope trifasciata (Forskoel)	V	*
Dictynidae (Mesh web weaver)			
	Dictyna spp.	P,V,S,C,W	***
Gnaphosidae (Ground spiders)			
	Pterotricha sp.	P	*
	Zelotes sp.	P	*
Linyphiidae (Sheet-web spider)			
	Bathyphantes spp.	P, V,S,C,W	***
	Erigone dentipalpis (Wider)	P, V,S,C,W	* *
	Gonathonarium sp.	V,S,C,W	*
Lycosidae (Wolf spider)			
	Hogna ferox (Locas)	P	**
	Pardosa spp.	P	* **
	Wadicosa fidelis (O.P. Cambridge)	P	**
Miturigidae (Long-legged sac spider)			
	Cheiracanthium spp.	P,V,S,C	* *
Clubionidae (Sac spider)			
	Clubiona sp.	V,S	*
Oxyopidae (Lynx spider)			
	Oxyopes sp.	V	*
Philodromidae (Philodromid crab spider)			
	Philodromus sp.	V	*
	Thanatus albini (Audouin)	P,V,S,C,W	***
Salticidae (Jumping spider)			
	Ballus sp.	V,S,C	**
	Bianor albobimaculatus (Lucas)	V,S,C	*
	Plexippus paykulli (Audouin)	V	*
	Salticus sp.	V	*
	Synageles sp.	V	*
	Thyene imperialis (Rossi)	V,S,C	**
Tetragnathidae (Long-jawed spider)			
	Tetragnatha sp.	V,S	*
Theridiidae (Comb-footed spider)			
	Steatoda sp.	V,S	*
	Theridion sp.	V,S,C	**
Thomisidae (Crab spider)			
	Runcinia sp.	V	*
	Thomisus spp.	P,V,S,C,W	***
	Xysticus spp.	V,C	*

P, Pitfall traps; V, Vacuum machine; W, Water pan traps; S, Sweep net; C, Cloth sheet.

Averages of spider numbers per catch were used to compare the relative occurrence of spider species.

*Species rarely found (< 5 individuals);

**Species are usually rare but occasionally reaching high numbers (6-12 individuals);

***Species always common in soybean fields (> 12 individuals).

Table (2): Role of soybean variety on common spider community at Sakha, Kafr El-Sheikh Governorate during season 2007.

Family/Species	No. of spider individuals /10 m long vacuumed and 5 pitfall traps in two soybean variety	
	Crawford	Giza 111
Araneidae		
Larinia sp.	8	3
Singa sp.	12	4
Dictynidae		
Dictyna spp.	47	23
Gnaphosidae		
Zelotes sp.	2	-
Linyphiidae		
Bathyphantes spp.	53	19
Erigone dentipalpis (Wider)	12	5
Lycosidae		
Hogna ferox (Locas)	8	1
Pardosa spp.	34	20
Wadicosa fidelis (O.P. Cambridge)	12	6
Miturigidae		
Cheiracanthium spp.	14	5
Philodromidae		
Thanatus albini (Audouin)	31	18
Salticidae		
Ballus sp.	7	2
Thyene imperialis (Rossi)	12	3
Tetragnathidae		
Tetragnatha spp.	4	1
Theridiidae		
Theridion sp.	10	4
Thomisidae		
Thomisus spp.	15	6
Total	281	120
average	17.5 ±2.1555	7.5± 1.0891
't' calculated = 4.167**		
't' tabulated, 5% =1.98, 1%= 2.63		

Table (3): Adverse effect of pesticides on population density of spiders in soybean fields at Kafr El-Sheikh Governorate, season 2007.

Days after treatment	Number of spiders/ 10 m by vacuum machine as affected by pesticides compound						
	Endo	Neoron	Ortus	Pestban	Spinosad	Water	Untreated
1	0	0	0	6	59	108	126
3	5	8	7	29	74	117	121
7	10	17	23	37	89	125	139
14	25	39	41	49	111	141	153
21	46	54	58	71	123	155	171
Mean	17.2 f	23.6^{e}	25.8^{e}	38.4^{d}	91.2^{c}	129.2^{b}	142.0^{a}
Reduction %	87.88	83.38	81.83	72.96	35.77	9.01	-

In a row, means followed by the same letter are not significantly different at the 5% level.

acaricides.

Spinosad that reduced the spider population by 35.77% in the current investigation was considered toxic to the earwigs (Cisneros *et al* 2001). They also concluded that Spinosad can not be considered to have an environmental safety profile similar to most established biological insecticides. Wilson *et al* (1998) reported that all sprayed insecticides caused significant reductions in all predatory complexes, including spiders.

Statistical analysis revealed significant differences in spider population density due to different insecticidal treatments, and means were compared using Duncan's Multiple Range Test (Table 3).

ACKNOWLEDGEMENT

The authors are grateful to Dr. Alberto Barrion, the taxonomist of International Rice Research Institute (IRRI), Philippines, and Mr. Hesham K. El-Hennawy (Taxonomist of arachnids, Egypt) for their sincere help in identifying and confirming the specimens of spiders and for providing valuable publications that contributed in preparing the paper. Too much thanks to Prof. Dr. Ahmed H. El-Heneidy and Prof. Dr. Mahmoud R. Sherif, Agricultural Research Center, Egypt for their valuable comments and reviewing the manuscript.

REFERENCES

Badenhop, A. F. and L.R. Hackler 1971. Protein quality of dry roasted soybean: amino acid composition and protein efficiency ratio. J. Food Sci., 36: 1-4.

Cisneros, J., D. Goulson, L. C. Derwent, D. I. Penago, O. Hernandez and T. Williams 2001. Toxic effects of Spinosad on predatory insects. Biological Control, 23:156-163.

Culin, J. D. and K.V. Yeargan.1983a. Comparative study of spider communities in alfalfa and soybean ecosystems: foliage-dwelling spiders. Annals of the Entomological Society of America, 76, 825-831.

Culin, J.D. and K.V. Yeargan.1983b. Comparative study of spider communities in alfalfa and soybean ecosystems: ground-surface spiders. Annals of the Entomological Society of America, 76, 832-838.

Culin, J.D. and R.W. Rust. 1980. Comparison of the ground surface and foliage dwelling spider communities in a soybean habitat. Environmental Entomology, 9, 577-582.

El-Dakhakhny, N.T.; I.S. El-Hawary; M.B. Shawer; M.S. Tadros and G.A. El- Mezayyen 1996.

Utilization of pitfall traps for sampling pests, beneficial and other insect species in clover, corn and soybean fields at Kafr El-Sheikh. J. Agric. Res. Tanta Univ., 22(3): 387-399.

Gamieh, G.N. and A.A. El-Basuony 2001. Population densities of piercing sucking pests in soybean fields as influenced by varieties, predators and leaf physical and chemical properties. J. Agric. Sci., Mansoura Univ., 26(2): 1089-1099.

Hendawy, A.S. 2003. Survey and abundance of orb-weaver spiders in the Egyptian rice fields and captured prey. J. Agric. Res., 82 (1): 283-293.

Hendawy, A.S. and G.A. El-Mezayyen. 2003. Arthropod composition in cotton fields as monitored by pitfall traps and some biological aspects of true spider, *Thanatus albini* (Audouin). Agric. Sci. Mansoura Univ., 28(11): 6941-6949.

Hendawy, A.S. and H.A.A. Abul-Fadl. 2004. Survey of true spiders' community and its response to chemical and organic fertilizers in the Egyptian corn fields. Egyptian Journal of Biological Pest Control, 14(1): 231-235.

Herbek, J.H. and Bitzer, M.J. 1988. Soybean Production in Kentucky, Part IV: Weed, Disease and Insect Control. Kentucky Cooperative Extension. Service Publishers AGR-131. University of Kentucky, Lexington, KY.

LeSar, C.D. and J.D. Unzicker 1978. Soybean spiders, species composition, population densities, and vertical distribution. Biological Notes, 107:3-14.

Magouz, R. I. E. 2003. Integrated spider mite management. Ph.D. Thesis, Fac. Agric. Tanta Univ., 258 pp.

Mesbah, I.,I.;.R.M.Y..Helal and A.S. Hendawy 2001. Population studies on parasitoids of *Melanagromyza sojae* (Zehnt.) (Diptera: Agromyzidae) in soybean fields at Kafr El-Sheikh region. J. Agric. Mansoura Univ., 26(5): 3215-3223.

Pearce S, W. M. Hebron, R. J. Raven, M. P. Zalucki, and E. Hassan 2004. Spider fauna of soybean crops in south-east Queensland and their potential as predators of *Helicoverpa* spp. (Lepidoptera: Noctuidae). Australian Journal of Entomology 43, 57–65

Rypstra, A. L and S. D. Marshall, 2005. Augmentation of soil detritus effects on the spider community and herbivore in a soybean agroecosystem. Entomologia Experimentalis et Applicata 116: 149–157.

Sallam, G. M. 1996. Studies on true spiders in Giza Governorate. M. Sc., Fac. Agric. Cairo Univ., 139 pp.

Sherif, M.R., A.S. Hendawy and M.M. El-Habashy 2001. Spiders occurring in the Egyptian rice fields and adverse effect of insecticides. J Agric. Res. Tanta Univ., 27(3): 463-470.

Wilson, L. J., L.R. Bauer and D.A. Lally 1998. Effect of early season insecticide use on predators and outbreaks of spider mites (Acari: Tetranychidae) in cotton.